10th Class 2015

Physics	Group-I	
Time: 2.45 Hours	(Subjective Type)	Max. Marks: 63

(Part-I)

2. Write short answers to any Six (6) questions: 12

(i) Define mechanical waves and give an example.

Ans Waves which require any medium for their propagation are called mechanical waves.

Water waves is the example of mechanical waves.

(ii) What is the reflection of sound?

Ans When sound is incident on the surface of a medium, it bounces back into the first medium. This phenomenon is called echo or reflection of sound.

(iii) Define pitch.

Ans Pitch is the characteristic of sound by which we can distinguish between a shrill and a grave sound.

(iv) Define intensity of sound and write the name of its unit.

Ans Sound energy passing per second through a unit area held perpendicular to the direction of propagation of sound waves is called intensity of sound.

The unit of intensity of sound is decibel (dB).

(v) Define refraction of light.

Ans The process of bending of light as it passes from one transparent medium into another is called refraction of light.

(vi) What are the applications of lenses?

Ans Lenses are used in optical devices such as cameras, eyeglasses, microscopes, telescopes and projectors.

(vii) Define the simple microscope.

Ans A magnifying glass is a convex lens which is used to produce magnified images of small objects. Hence, it is also called simple microscope.

(viii) Define electric field lines.

Ans The direction of electric field intensity in an electric field can also be represented by drawing lines. These electric field lines are also known as electric lines of force.

(ix) Define electroscope. Describe its construction.

Ans The electroscope (gold leaf electroscope) is a sensitive instrument for detecting charges. It consists of a brass rod with a brass disk at the top and two thin leaves of gold foil hanging at the bottom. The rod passes through an insulator that keeps the rod in place. A thin aluminium foil is attached on the lower portion of the inside of the jar. Usually, the aluminium foil is grounded by connecting a copper wire. This protects the leaves from the external electrical disturbances.

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3. Write short answers to any Five (5) questions: 10

(i) Write two uses of capacitor.

Ans 1. They are used for tuning transistors, receivers and transistor radios.

2. They are used to distinguish between high and low frequency signals.

(ii) What is difference between fixed and variable capacitors?

Ans In variable capacitor, the value of capacitance can be increased or decreased. In fixed type capacitors, the value of capacitance cannot be changed.

(iii) If 0.5 C charge passes through a wire in 10 s, then what will be value of current flowing through the wire?

Ans Given that,

$$Q = 0.5C, \quad t = 10s$$

Thus, by using:

$$I = \frac{Q}{t}$$

$$I = \frac{0.5C}{10s}$$

$$I = 0.05A$$

$$\boxed{I = 50\ mA}$$

(iv) Which devices are used to measure the current? Write names.

Ans Galvanometer and ammeter are some common examples of current measuring instruments.

(v) Which are the sources of e.m.f? Write names.

Ans Sources of electromotive force (e.m.f) are batteries, thermocouples and generators.

(vi) Define Ohm. Write its symbol.

Ans **Ohm**

When a potential difference of one volt is applied across the ends of a conductor and one ampere of current passes through it, then its resistance will be one ohm.

Unit:

The symbol of ohm is Ω.

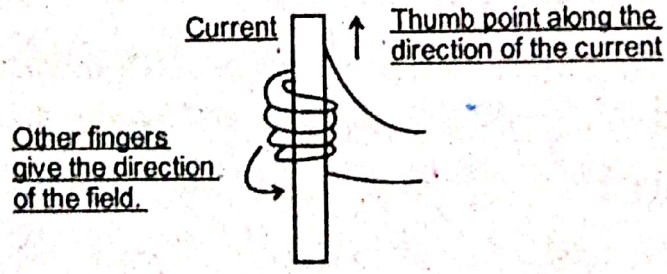
(vii) Write two advantages of parallel circuit.

Ans 1. Each device in the circuit receives the full battery voltage.

2. Each device in the circuit may be turned off independently without stopping the current flowing to the other devices in the circuit. This principle is used in household wiring.

(viii) Which is the principle to find the direction of magnetic field? State it.

Ans A simple method of finding the direction of magnetic field around the conductor is the right-hand rule.



It is stated as:

"Grasp a wire with your right hand such that your thumb points in the direction of the conventional (positive) current. Then curling fingers of your hand will point in the direction of magnetic field."

4. Write short answers to any Five (5) questions. 10

(i) What do you mean by step up and step down transformer?

Ans If the secondary voltage is larger than the primary voltage, the transformer is called a step-up transformer. If the secondary voltage is smaller than the primary voltage, that is called step-down transformer.

(ii) Describe the role of deflecting plates in cathode ray oscilloscope.

Ans After leaving the electron gun, the electron beam passes between a pair of horizontal plates. A potential difference applied between these plates deflects the beam in a vertical plane. This pair of plates provides the y-axis or vertical movement of the spot on the screen. A pair of vertical plates provides the x-axis or horizontal movement of the spot on the screen.

(iii) What do you mean by NOT gate? How does it work?

Ans The electronic circuit which implements NOT operation is known as NOT gate.

NOT gate performs the basic logical function called inversion or complementation. NOT gate is also called inverter. The purpose of this gate is to convert one logic level into the opposite logic level. When a high level is applied to an inverter, a low level appears on its output and vice versa.

(iv) What do you mean by information and communication technology?

Ans Information and communication technology (ICT) is defined as the scientific methods and means to store, process and transmit vast amounts of information in seconds with the help of electronic equipments.

(v) How a fax machine works?

Ans A fax machine basically scans a page to convert its text and graphic into electronic signals and transmits it to another fax machine through telephone line. The receiving machine converts the signals and uses a printer to create the copy of the message that was sent.

(vi) **Write names of four output devices of a computer.**

Ans 1. Printer 2. Monitor
3. USB (It is both input and outpout device.)
4. Speaker

(vii) **Describe two safety precautions to avoid hazards of radiations.**

Ans 1. The user should use rubber gloves and hands should be washed carefully after the experiment.

2. All radioactive sources should be stored in thick lead containers.

(viii) **How fission chain reaction is controlled?**

Ans The fission chain reaction is controlled in nuclear reactors. A nuclear reactor provides energy for useful purposes. In this sort of self-sustained reaction, extra neutrons liberated in fission reactions are absorbed using some material to slow down the chain reaction.

(Part-II)

NOTE: Attempt any Three (3) questions.

Q.5.(a) Define simple harmonic motion and prove that motion of mass attached with spring have simple harmonic motion. (4)

Ans **Simple Harmonic Motion: (SHM)**

We can define SHM as:

Simple harmonic motion occurs when the net force is directly proportional to the displacement from the mean position and is always directed towards the mean position.

Motion of Mass Attached to a Spring:

One of the simplest types of oscillatory motion is that of horizontal mass-spring system. If a spring is stretched or compressed through a small displacement x from its mean position, it exerts a force F on the mass.

According to Hooke's Law:

This force is directly proportional to the change in length x of the spring *i.e.*,

$$F = -kx$$

where x is the displacement of the mass from its mean position O, and k is a constant called the spring constant defined as:

$$k = \frac{-F}{x}$$

Stiffness of the spring:

The value of k is a measure of the stiffness of the spring. Stiff springs have large value of k and soft springs have small value of k.

As $F = ma$

Therefore, $k = \frac{-ma}{x}$

Or $a = \frac{-k}{m}x$

$a \propto -x$

Acceleration of a mass:

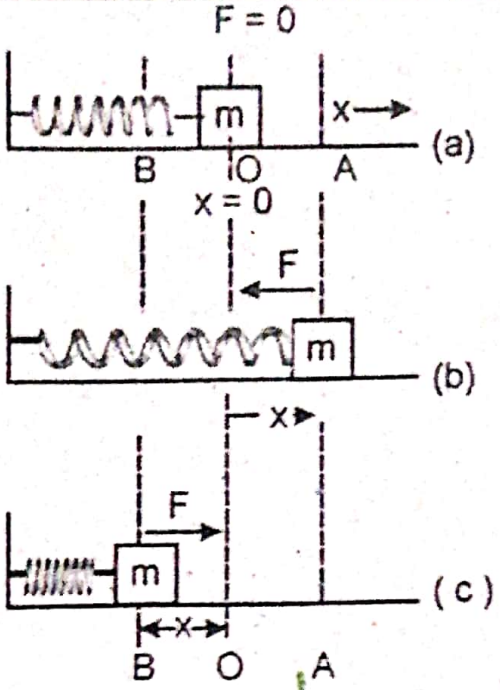
It means that the acceleration of a mass attached to a spring is directly proportional to its displacement from the mean position. Hence, the horizontal motion of a mass-spring system is an example of simple harmonic motion.

Reason of negative sign:

The negative sign, in the above equation, means that the force exerted by the spring is always directed opposite to the displacement of the mass. Because the spring force always acts towards the mean position, it is sometimes called a restoring force.

Restoring force:

A restoring force always pushes or pulls the object performing oscillatory motion towards the mean position.



ig. SHM of a mass-spring system.

ody at extreme position A:

e the mass is pulled through a distance x up e position A and then released. The restoring by the spring on the mass will put it towards sition O. Due to the restoring force, the mass towards the mean position O. The magnitude ng force decreases with the distance from the n and becomes zero at O. However, the speed as it moves towards the mean position d becomes maximum at O. Due to the inertia, oes not stop at the mean position O but motion and reaches the extreme position B.

ody at extreme position B:

mass moves from the mean position O to the tion B, the restoring force acting on it towards sition steadily increases in strength. Hence the mass decreases as it moves towards the ition B. The mass finally comes briefly to rest ne position B. Ultimately, the mass returns to sition due to the restoring force.

ocess is repeated, and the mass continues to

$$T = 2\pi\sqrt{\frac{m}{k}}$$

(b) Calculate the frequency of a sound wave of speed 340 ms^{-1} and wavelength 0.5 m. (3)

Ans Given that;

Speed of waves $v = 340\ ms^{-1}$

Wavelength $\lambda = 0.5\ m$

Using the formula $v = f\lambda$

Putting the values

$$f = \frac{340\ ms^{-1}}{0.5\ m}$$

$$f = 680\ Hz$$

Q.6.(a) Draw ray diagram to show the formation of image in the normal human eye. (4)

Ans

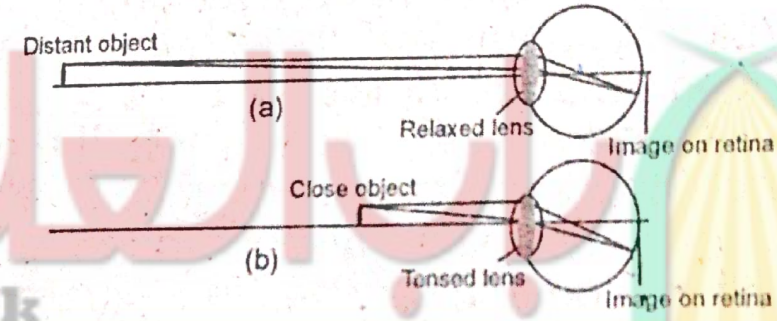


Fig. Human eye accommodation.

Image formation of object away from the eye:

If an object is far away from the eye, the deviation of light through the lens must be less. To do this, the ciliary muscles relax and decrease the curvature of the lens, thereby increasing the focal length. The rays are thus focused onto the retina producing a sharp image of the distant object. (As shown in the above figure (a)).

Image formation of object close to eye:

If an object is close to the eye, the ciliary muscles increase curvature of the lens, thereby, shortening the focal length. The divergent rays from the nearer object are thus bent more so as to come to a focus on the retina (as shown in the above figure (b)).

Accommodation:

The variation of focal length of eye lens to form a sharp image on retina is called accommodation. It is large in young people while it goes on decreasing with age.

Correction of accommodation defects:

Defects in accommodation may be corrected by using different type of lenses in eyeglasses.

(b) An object and its image in a concave mirror are of the same height, yet inverted, when the object is 20 cm from the mirror. What is the focal length of the mirror? (3)

Ans Given data:

Distance of object $p = 20$ cm

Distance of image $q = 20$ cm

To find:

Focal length = f = ?

Solution:

Using the formula:

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

By putting values, we get.

$$\frac{1}{f} = \frac{1}{20} + \frac{1}{20}$$

$$\frac{1}{f} = \frac{1+1}{20}$$

$$\frac{1}{f} = \frac{2}{20}$$

$$f = \frac{\cancel{20}}{\cancel{2}}$$

$$f = 10 \text{ cm}$$

Q.7.(a) Write a note on Coulomb's law. (4)

Ans Coulomb's law:

The force of attraction or repulsion between two point charges is directly proportional to the product of the magnitude of charges and inversely proportional to the square of the distance between them.

Mathematical Notation:

$$F \propto q_1 q_2 \qquad (A)$$

$$F \propto \frac{1}{r^2} \qquad (B)$$

Combining equations (A) and (B), we get

$$F = k\frac{q_1 q_2}{r^2} \qquad (C)$$

Thus, equation (C) is known as Coulomb's law.

Dependence of value of k in air:

The value of k depends upon the medium between the two charges. If the medium is air between the two point charges, then value of k in SI unit will be 9×10^9 Nm^2C^{-2}.

(b) The resistance of a conductor wire is 10 M Ω. If a potential difference of 100 V is applied across its ends, then find the value of current passing through it in mA? (3)

Ans **Given data:**

$R = 10\ M\Omega = 10 \times 10^6\ \Omega$

$V = 100\ V$

To find: $I = ?$

Solution:

Using Ohm's law:

$$V = IR$$

$$I = \frac{V}{R}$$

By putting all values, we get

$$I = \frac{100\ V}{10 \times 10^6\ \Omega}$$

$$I = \frac{10^2\ V}{10^7\ \Omega}$$

$$I = 10^{-5}\ V\ \Omega^{-1}$$

$$I = 0.00001\ A$$

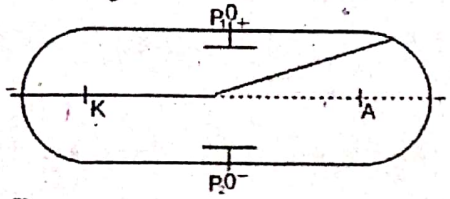
$$I = 0.00001 \times 1000\ mA$$

$$I = 0.01\ mA$$

Q.8.(a) Explain deflection of electrons by electric and magnetic fields. (4)

Ans **Deflection of electrons by electric field:**

We can set up electric field by applying a potential difference across two parallel metal plates placed horizontally separated by some distance.



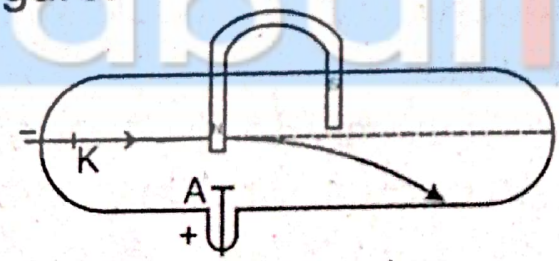
In the above figure, we can see; when an electron beam passes between the two plates, the electrons are deflected towards the positive plate.

Reason and result:

The reason for this is that electrons are attracted by the positive charges and are repelled by the negative charges due to force $F = qE$, where q is the electron charge and E is the electric field due to plates. The degree of deflection of electrons from their original direction is proportional to the strength of the electric field applied.

Deflection of electrons by magnetic field:

Now we apply magnetic field at right angle to the beam of electrons by using a horseshoe magnet as shown in the following figure:



Result:

We will notice that the spot of the electrons beam on the screen is getting deflected from its original direction. Now change the direction of the horseshoe magnet. We will see that spot on the fluorescent screen is getting deflected in the opposite direction.

(b) A step down transformer needed to convert a mains 240 V supply into a 12 V supply. If there are 2000 turns on the primary coil, then find the number of turns on the secondary coil. (3)

Ans For Answer see Paper 2014 (Group-I), Q.8.(b).

Q.9.(a) How radioisotopes are used as tracers and in medical treatment? (4)

Ans **Uses of Radioisotopes:**

Radioisotopes are used as tracers in medicine, industry and agriculture. For example, radio iodine-131 can be used for the monitoring of thyroid functioning. For the diagnosis of brain tumor, phosphorus-32 is used.

1. Tracers:

In industry, tracers can be used to locate the wear and tear of the moving parts of the machinery. They can be used for the location of leaks in underground pipes.

In agriculture, radio phosphorous-32 is used as a tracer to find out how well the plants are absorbing the phosphate fertilizer which are crucial to their growth.

2. Medical treatment:

Radioisotopes are also used in nuclear medicines for curing various diseases. For example, radioactive cobalt-60 is used for curing cancerous tumors and cells.

(b) What are the risks of ICT to society and environment? (3)

Ans ICT is dangerous to the society and the environment in the following ways:

1. Over-use of computer is dangerous for our health. Computer crimes are also very common these days.
2. Theft is the most common form of crime. Computers are used to steal money, goods, information and computer resources.
3. Privacy is another issue of importance which is common on computer. It is the illegal duplication of copyright material like books, papers, software, etc.
4. Hacking is still another illegal activity which is committed on computers. Computer hackers can

damage some organization by stealing their credit cards and valuable information.

(Part-III)

(Practical Part)

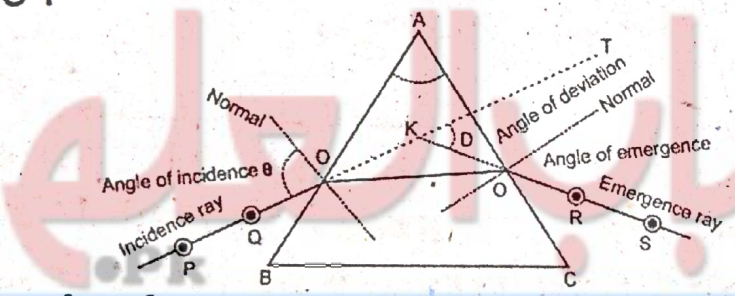
A-(i) Write down the procedure to determine the path of ray light in prism. (3)

Ans **Prism:**

Prism is a transparent object which has three rectangular and two triangular surfaces. The angle of the triangular surface opposite to its base is called angle of prism. It is denoted by A.

The path of ray in prism:

We can determine the path of ray in prism through the following procedure:



Material required:

Glass prism, common pins, sheet of paper, cello-tape, ruler, protractor.

Procedure:

1. Fix a paper sheet on the drawing board with a cello-tape.
2. Place a glass prism in the middle of the sheet in such a way that its base is towards you.
3. Mark the boundary of the prism with a sharp pencil. Indicate the angle of prism as A and base of the prism as BC.
4. Fix a pin Q at about middle of the side AB of the prism. Fix another pin P at about 5 cm away from the pin Q as shown in the above figure.
5. Observe through the side AC and locate the position where both the pins P and Q come in a line.

6. Keeping eye in the same position fix two more pins R and S on the side AC in such a way that all the four pins appear to be in the same straight line.
7. Remove the prism and pins and encircle the pin pricks carefully.
8. Join points P and Q by a straight line and extend this line to the face AB. It meets the face AB at point O.
9. Similarly, join points R and S by a straight line and extend it to the face AC. It meets AC at point O′.
10. Join points O and O′ by a straight line. POO′S is the path of the light ray passing through the prism.

(ii) Define power of lenses. (2)

Ans The reciprocal of focal length is called power of lenses, *i.e.*,

$$P = \frac{1}{f}$$

B- Find equivalent resistance, when three resistances are combined in parallel. Draw circuit diagram and find current passing through each resistance, when: (5)

$R_1 = 4\ k\Omega$, $R_2 = 3\ k\Omega$, $R_3 = 6\ k\Omega$ and $V = 12V$

Ans **Equivalent Resistance:**

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_{eq}} = \frac{1}{4} + \frac{1}{3} + \frac{1}{6}$$

$$= \frac{3+4+2}{12} = \frac{9}{12} = \frac{3}{4}$$

$$R_{eq} = \frac{4\ k\Omega}{3}$$

Current passing through R_1

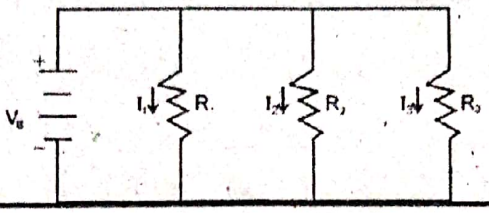
$$I_1 = \frac{V}{R_1} = \frac{12\ V}{4\ \Omega} = 3A$$

Current passing through R_2

$$I_2 = \frac{V}{R_2} = \frac{12\ V}{3\ \Omega} = 4A$$

Current passing through R_3

$$I_3 = \frac{V}{R_3} = \frac{12\ V}{6\ \Omega} = 2A$$



C-(i) Draw truth table for NOR gate. **(2)**

Ans The NOR operation is simply an OR operation followed by a NOT operation. The NOR gate is obtained by coupling the output of the OR gate with the NOT gate.

Thus, for the same combination of inputs, the output of a NOR gate will be opposite to that of an OR gate.

Its Boolean express is $X = \overline{A + B}$.

Truth Table:

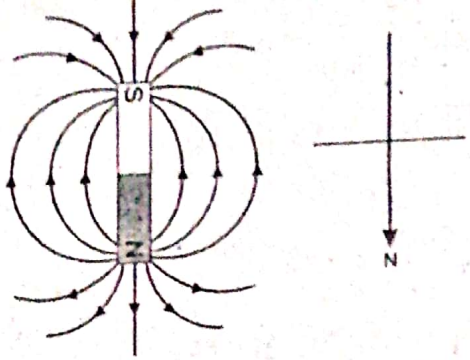
A	B	$X = \overline{A + B}$
0	0	1
0	1	0
1	0	0
1	1	0

(ii) Write the procedure to trace the path of magnetic field by bar magnet. **(3)**

Ans Procedure to trace the path:

Material required:

Bar magnet, compass needle, drawing board, sheet of paper, cello tape and piece of chalk.



Necessary information:

Magnet:

A substance which has a tendency to attract certain material like iron, nickel, cobalt, etc. is called a magnet.

Magnetic field:

The region or space around a magnet where it shows its effect of attraction on magnetic materials or another magnet is called magnetic field.

Magnetic lines of force:

Magnetic field is usually represented by drawing arrow lines indicating the direction of the magnetic force. These lines are called magnetic lines of force. Magnetic lines of force are traced by a compass needle.

Two Poles:

A magnet has two poles: North pole and south pole.

Procedure:

1. Fix the paper sheet on the drawing board with the help of cello tape.
2. Draw a line at the centre of the sheet.
3. Place the compass needle on this line.
4. Adjust the orientation of the drawing board such that the ends of the compass needle point along the line. Mark N for north and S for south.
5. Mark the boundary of the board on the table top with a piece of chalk.
6. Place the magnet on the line with its north pole pointing towards geographical north. Draw the boundary of the magnet with a pencil.

7. Put a dot on the paper near to north pole of the magnet.

8. Place the compass needle near the dot such that its south end points towards the dot. Put the next dot at the north end.

9. Repeat the process till it reaches the south pole of the bar magnet.

10. Draw a free hand line by joining all the dots. The line will originate from north pole and terminate at south pole. Mark arrow heads on this line from north towards south.

11. Similarly, draw a number of lines on both sides of the bar magnet.

12. The drawn lines show the magnetic field of the bar magnet.